MATH LESSONS

SHOW ME THE M**O**NEY$$$$$$$$$$$$$

Measurements! Microscopes! And Money!!!
Various Math Lessons for all age groups!

Use as appropriate for your student population for individual or group exploration.

1. (G4-10)Measure the sizes of coins and bills using metric rulers. Tech Trek has small plastic ones to use and keep.
2.

		(x10)	(mm x 1000)
a. penny-	___cm	_____mm	_____μm
b. nickel	___	_____	_____
c. dime	___	_____	_____
d. quarter	___	_____	_____

Alternatives: for extension. Measure the currency then :(G6-10)

e. Susan B Anthony Dollar- Do a biography on her and present it.
f. Kennedy Half Dollar- Do a biography on him and present it.
g. Measure Lincoln on the penny using the S.E.M. and other objects on coins.

h. Paper Denominations 1$-20 including the latest 20$ bill. Who is on each and what were their contributions to U.S. History?

3. Measure bills in inches (**if you must**) then convert to metric units.

4. Knowing the measurements of a paper bill in inches and /or centimeters, allows measurements to be made when there is no measuring device available. Their standard size and general availability make them useful for this task as opposed to carrying a tape measure. **Approximations can be made knowing this information also.*

a. What is the measured distance of the currency? Make several estimates of items within the classroom then measure them to compare your eyed estimate. How did you measure up?

b. (G5-8) Form several small groups. The teacher presents several objects and the class estimates the size of the object and bids that dollar amount. All bids must be in dollars. (For example: the longest side of a shoe box appears to measure approximately three dollars.) After all bids are in, each group measures an object. The closet bidders win. Prizes are optional.

5. (G7-12) Convert diameters of coins to radius- (r =1/2d)
    a. Define diameter verses radius and conversion method.
    b. Emphasize consistent units.
    c. Define pi or Π, which is 3.14, a "constant" for them to memorize.
    d. Use the formulae, Πr^2 to determine coin circumference. Sizes can be compared among the coins and graphed.
    e. Convert centimeters to Millimeters (x10)
    f. Convert millimeters to micrometers (μm), x1000
    g. (G9-12)List units from large visible spectrum to nonvisible spectrum and link this to the use of microscopy.
    h. Show video on scientific notation, and refer to "Powers of Ten".

    i. You may choose to use smaller units, such as (nm) nanometers (Å) and Angstroms and so forth. Refer to cell size and their components to give students a perspective on these units. Red blood cells can be seen under the S.E.M. Glass slides viewed under the compound light microscopes; also allow students an additional frame of reference.

    j. Use and refer to anatomy and biology specimens that can be visualized using microscopes.

6. (G7-12)The making of a bill or coin would involve a step wise process. Metal alloys must be mixed in specific amounts (%), for the coins to be standard weight, and to fit the molds they are to be poured into.

a. Material science, metallurgy and chemistry can be reviewed or introduced. The paper making process, strength of materials, and heat tempering treatments can be explored.

7. (G5-12) **Create a Country**: Students can meet as a group and decide what steps need to be taken to generate and design **their own currency for their own country**.

Considerations: Modify for age appropriateness. Possible explorations and requirements might include:

a. Symbols, landmark information, denominations, security, circulation amount, size, disposal, etc. will need to be considered.

8. (G7-12)Research: Students can work in groups but can be assigned a specific area and specialize on the current methods that our U.S. Treasury Department uses to make money. For example: **Size-** Before the printing on the bill or blanking of the metal is proposed, information about the worth has to be displayed, and other authorized information as determined by the U.S. Treasury Department. The currency must fit in current machine devices such as vending machines that use (currency

readers). Choosing a standard size will help the economy. Why?

9. (k-6) Choose a form of currency and fold it in half or fourths. Do a freehand sketch without visual assistance (just the naked eye) interpretation of that area.

Now place the same area under a hand lens or the Intel microscope and focus in as much as possible. Draw the details now. You may print the area and compare the drawings. Were there more details than you thought? Why do you think currency is so detailed?

10. Examine a 5$ dollar bill using the Intel Play Microscopes.
    a. What structures are located on the bill?
    b. Read the name of the landmark on the bill. Research this historical landmark. Why was it chosen?
    c. Which States are listed on the architecture?
    d. What questions do you have about other symbols found on the bill?

11. **Choose several S.E.M. specimens** or items to place under the light microscopes. Have students estimate their sizes and convert them to different units.

    a. What are the average sizes of the scales on a butterfly's wing? Click and drag with the S.E.M.

    b. How many lenses are in a square area of a fly's eye? Can we infer the number of lenses on the whole eye by measuring a portion?

c. Go Buggy! Measure the claws, jaws, or legs that help them crawl.

d. Compare the sizes of pollens for different plants. Knowing these sizes, allow the class to construct, or recommend an appropriate filter that will keep the pollen out of the air for those who might be allergic. Where might these filters be placed? What materials should be used to construct a filter? What are the commonly used types of filters? (Example: oil, furnace, surgical masks) Study the different common allergies.

e. Various objects are placed in the S.E. M. and under the light microscopes. The items are listed on one side and the measurements of each are listed on the other side. The measurements are scrabbled. Students must measure them to be able to connect the size to the object.

f. Create a measurement treasure hunt. One number from each measured object is a part of a code that can be cracked by a small group to reveal a message, slogan, answer to a question or riddle. Be creative.